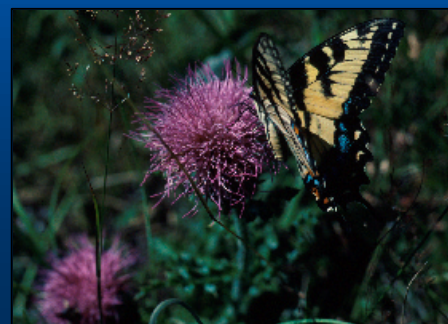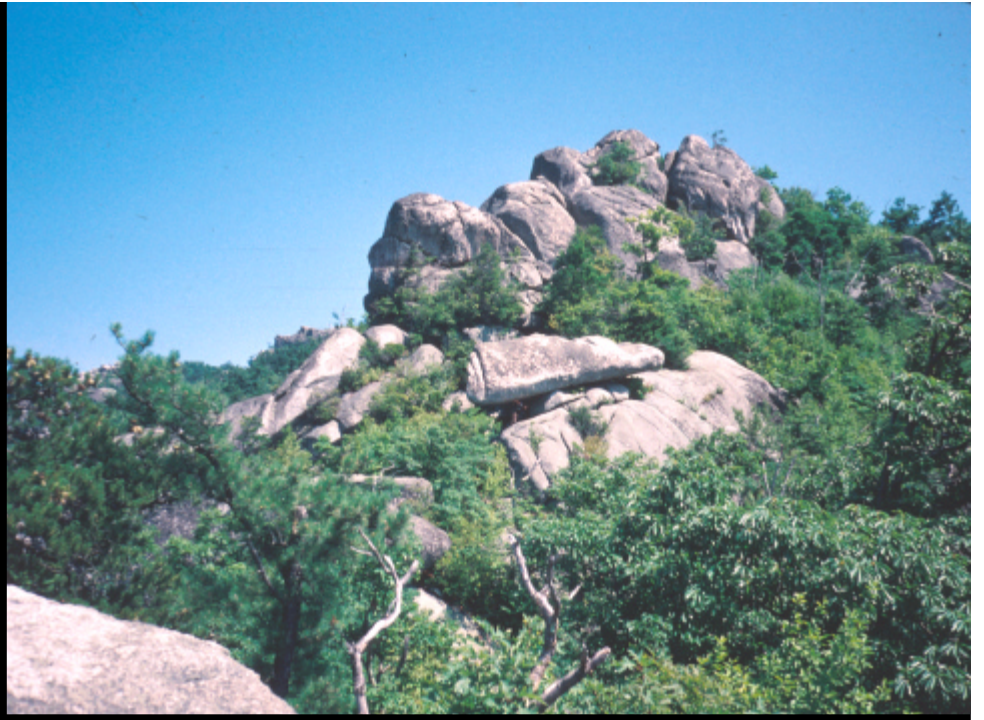# MONITORING OBJECTIVES

NCR Workshop July 10, 2002

Acknowledgements

- Robert D. Sutter,
  Director of Biological Conservation
  Southeast Regional Office

- Measuring & Monitoring Plant Populations
  BLM Technical Reference 1730-1
  C.L. Elzinga, D.W. Salzer, and J.W. Willoughby

Goals vs Objectives

- A __goal__ is a very general statement about what you want to do.

  "monitor forest vegetation"

- An __objective__ is a more specific statement about a quality that you want to measure.

  "describe change in tree basal area within high-elevation fir forest between 2000 and 2010"

Monitoring Objectives

Adaptive Management Monitoring Objectives - Objectives designed to measure resource changes that are connected to specific management goals and objectives

Ecosystem Monitoring Objectives - Objectives designed to measure resource changes over time
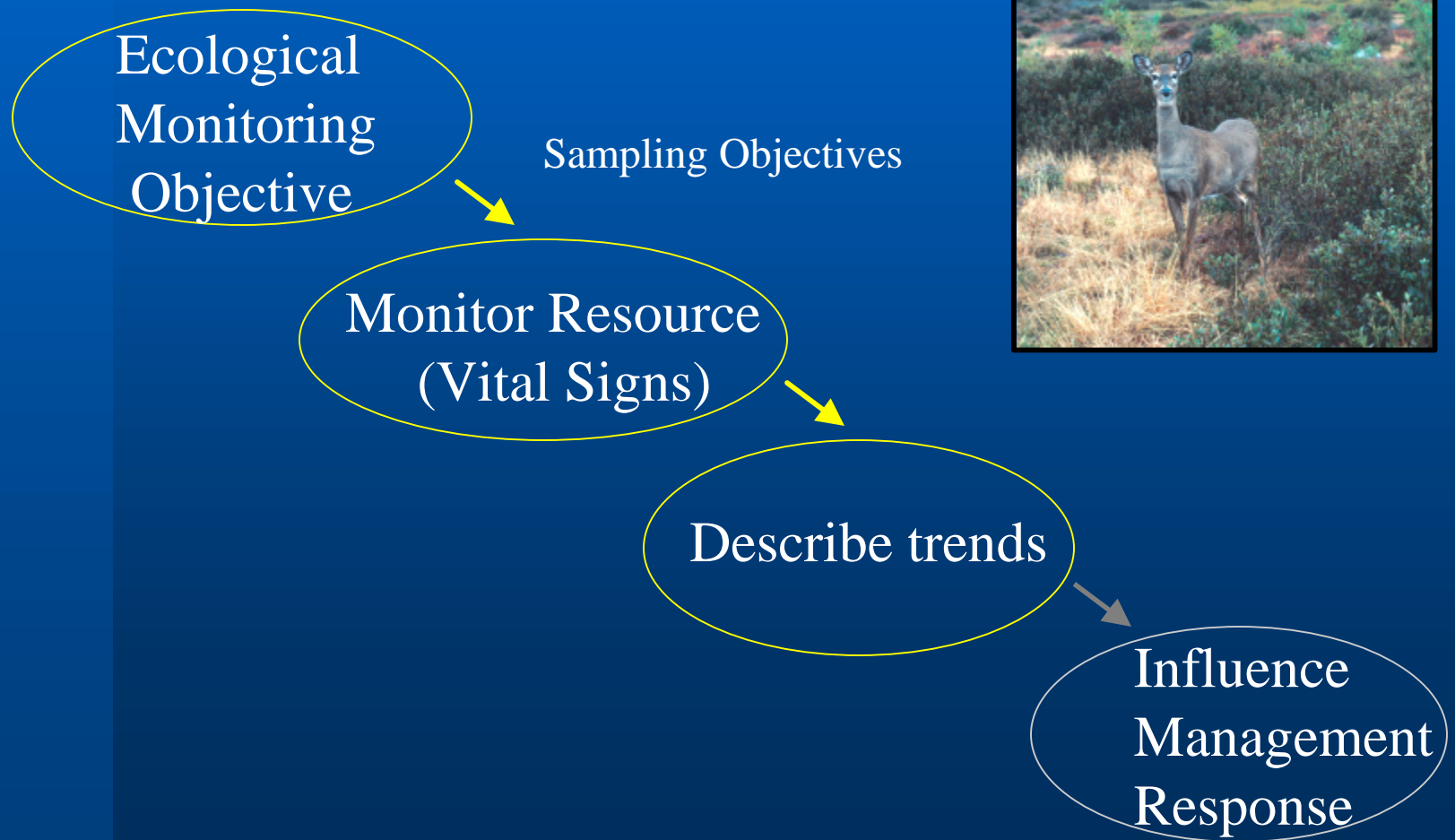
Adaptive Management Cycle

Adaptive Management Cycle (I&M)

Management
passive / active

Sampling
Objective

Adaptive Management
Monitoring Objective

Monitor
Resource /Vital Sign

Objective
Achieved?

yes

no

Alternative
Management

Ecological Monitoring

Ecological Monitoring Objective

Sampling Objectives

Monitor Resource (Vital Signs)

Describe trends

Influence Management Response

Part 1

Adaptive Management Monitoring Objectives

1. **Identify the six different components of an adaptive management monitoring objective**

2. **Identify and differentiate between two categories of adaptive management monitoring objectives**

What is an Objective?

An objective is a clearly articulated description of a

- measurable standard
- desired state
- threshold value
- amount of change
- trend

that you are striving to achieve for a particular population or habitat characteristic.

Why Write Objectives?

- Focus thinking

- Describe desired condition

- Determine management implementation

- Provide monitoring direction

- Provide a measure of success

- Identify resource needs

Qualities of an Objective

- REALISTIC

- SPECIFIC

- MEASURABLE

Components of an Objective

1. Species or Habitat Indicator

2. Location

3. Attribute

4. Action

5. Quantity / State

6. Time Frame

Species or Habitat Indicator

1. **Species or Habitat Indicator**
2. **Location**
3. **Attribute**
4. **Action**
5. **Quantity/State**
6. **Time Frame**

DIRECT

- Target Species
- Subset to be Sampled

"All *Iris versicolor* in population two at Big Meadows Swamp."

Species or Habitat Indicator

1. **Species or Habitat Indicator**
2. **Location**
3. **Attribute**
4. **Action**
5. **Quantity/State**
6. **Time Frame**

INDIRECT
- Abiotic (tire tracks, water quality)
- Other species (exotics invasion)
- Structural (woody encroachment)
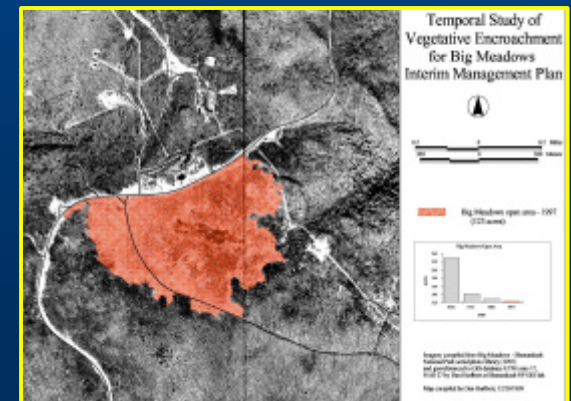
"Asiatic bittersweet density within the Big Meadows Swamp"

Location

? Clearly delineate the specific entity or area of management concern

? Take into account conservation goals, species biology, resource limitations

Temporal Study of Vegetative Encroachment for Big Meadows Interim Management Plan

Attribute

- What aspect of the species or indicator will you measure?

- This can be QUANTITATIVE or QUALITATIVE

Attributes - Quantitative

1. **Species or Habitat Indicator**
2. **Location**
3. **Attribute**
4. **Action**
5. **Quantity/State**
6. **Time Frame**

- Density
- Cover
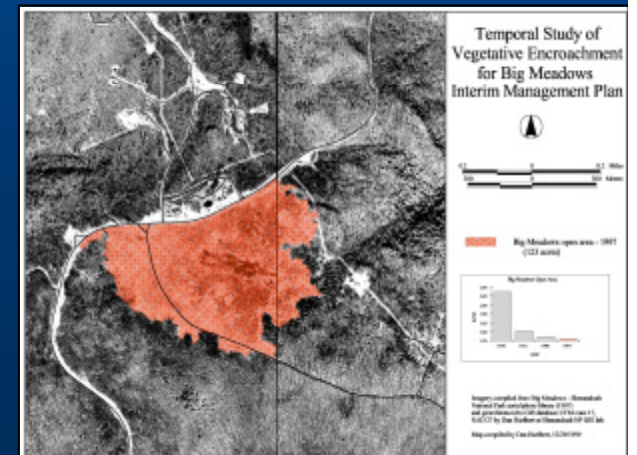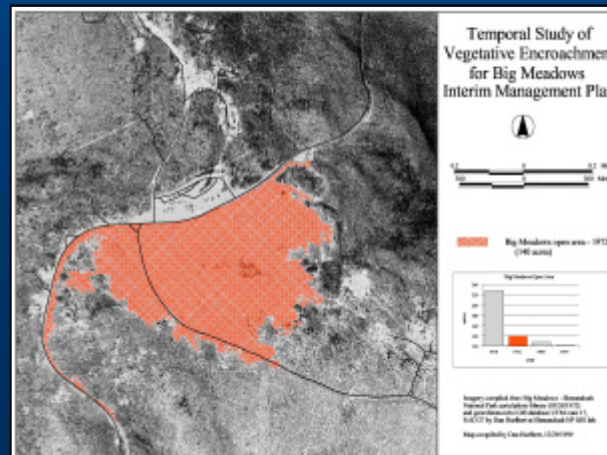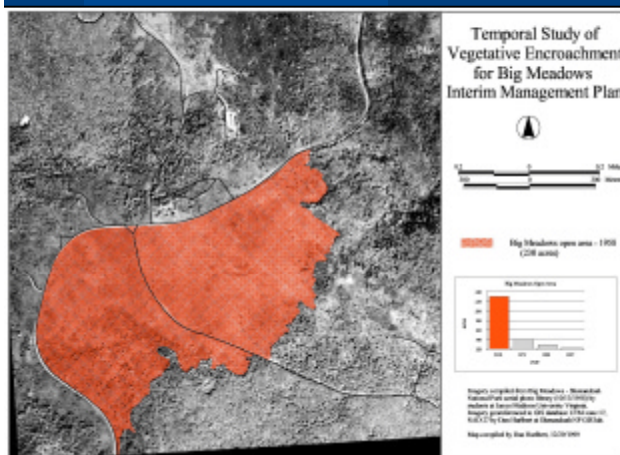- Frequency
- Vigor
- Demography

Attributes - Qualitative

1. **Species or Habitat Indicator**
2. **Location**
3. **Attribute**
4. **Action**
5. **Quantity/State**
6. **Time Frame**

- Abundance estimate
- Aerial extent
- Presence / Absence

Action

1. **Species or Habitat Indicator**
2. **Location**
3. **Attribute**
4. **Action**
5. **Quantity/State**
6. **Time Frame**

- Maintain

- Limit

- Increase (or Restore)
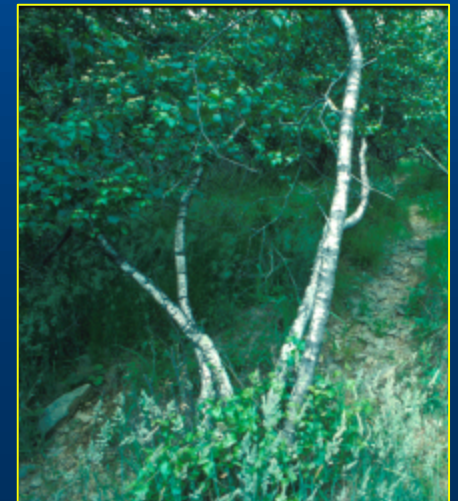
- Decrease

Quantity / State

1. **Species or Habitat Indicator**
2. **Location**
3. **Attribute**
4. **Action**
5. **Quantity/State**
6. **Time Frame**

The measurable value that will describe the "ACTIONS"

Quantity = 20% cover

Qualitative State = cover class 4

Quantity / State Considerations

1. **Species or Habitat Indicator**
2. **Location**
3. **Attribute**
4. **Action**
5. **Quantity/State**
6. **Time Frame**

- How much can the species respond?
- What is necessary to ensure species or population viability?
- How much change is biologically meaningful?
- What is the intensity of management?

Quantity / State Considerations

- What is the management implementation schedule ?

- What are the costs and problems associated with measuring the amount of change specified?

Quantity / State Challenges

1. **Species or Habitat Indicator**
2. **Location**
3. **Attribute**
4. **Action**
5. **Quantity/State**
6. **Time Frame**

? Poorly Understood Ecology

? Difficulty Predicting Management Response

- Natural fluctuations in numbers

- Human Impacts

- No data on historic conditions, number

- No data on minimum viable pop. size

Time Frame

? Affected by species biology, intensity of management, and amount of change specified.

? Select the shortest one possible: long enough for change to happen, yet short enough to get relevant data.

CHANGE / TREND

Describes a change relative to the existing situation

" increase density by 20%"

TARGET / THRESHOLD

Describes a desired condition of the species or community

"maintain at 2002 level"

The Link Between Types:

Change / Trend

Increase mean density of *Euphorbia purpurea* in Pocosin hollow by 20% between 2001 and 2003.

If you sample and find that current density is 10 plants per m^2, then ...

Target / Threshold

Increase mean density of *Euphorbia purpurea* in Pocosin hollow to 12 plants / m^2 by 2003.

Change / Trend Objective

Action

Attribute

Increase the number of stems of *Aralia hispida* at the Pond Ridge site by 20% by 2010.

Species

Location

Quantity

Time Frame

Target / Threshold Objective

Action

Attribute

Species

Location

Maintain the number of individuals of *Plethodon Shenandoah at the Stonyman Mountain* site at 2001 levels through 2011.

Quantity

Time Frame

Part 2
Sampling Objectives

1. Review the two sampling objective components to include with target / threshold adaptive management monitoring objectives

2. List the three sampling objective components to include with change / trend adaptive management monitoring objectives

How are Sampling Objectives Different?

- Adaptive management monitoring objectives set a specific goal for attaining or maintaining an ecological condition or change value.

- Sampling objectives set a specific goal for measuring that value.

Example of Paired Objectives

Adaptive Management Monitoring Objective

We want to see a 20% increase in the average density of *Carex polymorpha* at Cool Spring Hollow between 1999 and 2003.

Sampling Objective:

We want to be 90% sure of detecting a 20% change in the density and we are willing to accept a 1 in 10 chance that we will say a change took place when it really did not.

Target /Threshold Sampling Objectives Must Include

Confidence Level:

How confident do you want to be that your confidence interval will include the true value?

Confidence Interval Width:

How wide a range are you willing to accept around your estimated value?

Example of Target / Threshold Objectives

Management Objective:

We want to maintain a population of *Menyanthes trifoliata* at Big Meadows Swamp with at least 200 individuals from 2002-2006.

Confidence Interval Width

Sampling Objective: Confidence Interval

We want to be 90% confident that *Menyanthes trifoliata* population estimates are within ± 20% of the estimated true value.

Change / Trend Sampling Objectives Must Include

?☞ **The Acceptable Level of <u>Power</u>** **(missed change, type II error)**

> How certain do you want to be that if
> a change occurs you will detect it?

?☞**The Acceptable false-change error** (type I error, <u>?</u>)

> What is the acceptable threshold value for determining
> whether an observed difference actually occurred?

?☞ **The Desired Minimum Detectable Change (<u>MDC</u>)**

> Specifies the smallest change that you
> hope to be able to detect with your sampling.

Possible Errors when Monitoring for Change

	NO CHANGE HAS TAKEN PLACE	THERE HAS BEEN A REAL CHANGE
MONITORING SYSTEM DETECTS A CHANGE	FALSE CHANGE ERROR (TYPE 1) Alpha ?	NO ERROR (POWER) 1-Beta 1- ?
MONITORING SYSTEM DETECTS NO CHANGE	NO ERROR (1-Alpha) 1- ?	MISSED CHANGE ERROR (TYPE II) Beta ?

Example of Change / Trend Objectives

Management Objective:

We want to see a 10% increase in the average basal area of *Quercus rubra* within the red oak forest cover type between 1995 and 2005.

Power

MDC

Sampling Objective:

We want to be 90% sure of detecting a 10% change in the basal area of *Quercus rubra and* are willing to accept a 1 in 10 chance that we will say a change took place when it really did not.

?

Components of Sampling Objectives

What is the purpose of Sampling?

Target /threshold
To estimate population size or some average value at a single time or repeated intervals

Change / trend
To track changes over time in some average value

Sampling Objective Components

- **Specify desired confidence level**
- **Specify desired confidence interval width**

Sampling Objective Components

- **Specify acceptable level of the false-change error rate (?)**
- **Specify the power or the missed change error rate**
- **Specify the magnitude of change you want to be able to detect, MDC**